

Claims

What is claimed is:

1. An engine comprising:
an exhaust conduit;
an intake conduit;
a primary exhaust gas recirculation conduit for recirculating at least a portion of gases flowing through the exhaust conduit into the intake conduit;
the primary exhaust gas recirculation conduit being in fluid communication with a vortex tube disposed between the exhaust conduit and the intake conduit, the vortex tube having an inlet in fluid communication with the exhaust conduit, a cold gas outlet in fluid communication with the intake conduit, and a hot gas outlet.
2. The engine of claim 1, further including a venturi tube in fluid communication with the exhaust conduit and the intake conduit.
3. The engine of claim 1, further including an exhaust gas recirculation valve.
4. The engine of claim 3, wherein the exhaust gas recirculation valve is disposed in a cold exhaust gas recirculation conduit that connects the cold gas outlet in fluid communication with the intake conduit.
5. The engine of claim 3, wherein the exhaust gas recirculation valve is electronically controlled.

6. The engine of claim 1, wherein the hot gas outlet is in fluid communication with a turbine section of a turbocharger.

7. The engine of claim 1, further including a secondary cold exhaust conduit adapted to divert at least a portion of cold exhaust gases exiting from the cold outlet to be reunited with exhaust gases exiting from the hot outlet.

8. The engine of claim 7, wherein the secondary cold exhaust conduit includes a flow reduction valve.

9. The engine of claim 8, wherein the flow reduction valve is electronically controlled.

10. The engine of claim 1, further including a bypass conduit providing a fluid connection between the exhaust conduit and the cold exhaust recirculation.

11. The engine of claim 1, further including an electronic control unit and at least one sensor operatively connected to the electronic control unit, wherein the electronic control unit is adapted to generate appropriate control signals for use in controlling the flow of recirculated exhaust gases based upon output signals received from the sensor.

12. An engine exhaust system, comprising:
an exhaust conduit;
an intake conduit;
a vortex tube disposed between the exhaust conduit and the intake conduit, the vortex tube having an inlet in fluid communication with the exhaust conduit, a cold gas outlet in fluid communication with the intake conduit, and a hot gas outlet.
13. The engine exhaust system of claim 12, further including a venturi tube in fluid communication with the exhaust conduit and the intake conduit.
14. The engine exhaust system of claim 12, further including an exhaust gas recirculation valve.
15. The engine exhaust system of claim 12, further including a secondary cold exhaust conduit adapted to divert at least a portion of cold exhaust gases exiting from the cold outlet to be reunited with exhaust gases exiting from the hot outlet.
16. The engine exhaust system of claim 15, wherein the secondary cold exhaust conduit includes a flow reduction valve.
17. The engine exhaust system of claim 16, wherein the flow reduction valve is electronically controlled.

18. The engine exhaust system of claim 12, further including a bypass conduit providing a fluid connection between the exhaust conduit and the cold exhaust recirculation.

19. The engine exhaust system of claim 11, further including an electronic control unit and at least one sensor operatively connected to the electronic control unit, wherein the electronic control unit is adapted to generate appropriate control signals for use in controlling the flow of recirculated exhaust gases based upon output signals received from the sensor.

20. A method of recirculating exhaust gases in an internal combustion engine having a combustion chamber, the method comprising:

diverting at least a portion of exhaust gases;

cooling at least a portion of the diverted exhaust gases in a vortex tube; and

reintroducing the cooled exhaust gases into the combustion chamber.

21. The method of claim 20, wherein the cooled exhaust gases are reintroduced into the combustion chamber after passing through a venturi conduit.